Dec. 4, 1956 S. C. BAKER 2,773,141

IGNITION ELEMENT

Filed Dec. 24, 1953

Fig. 1.

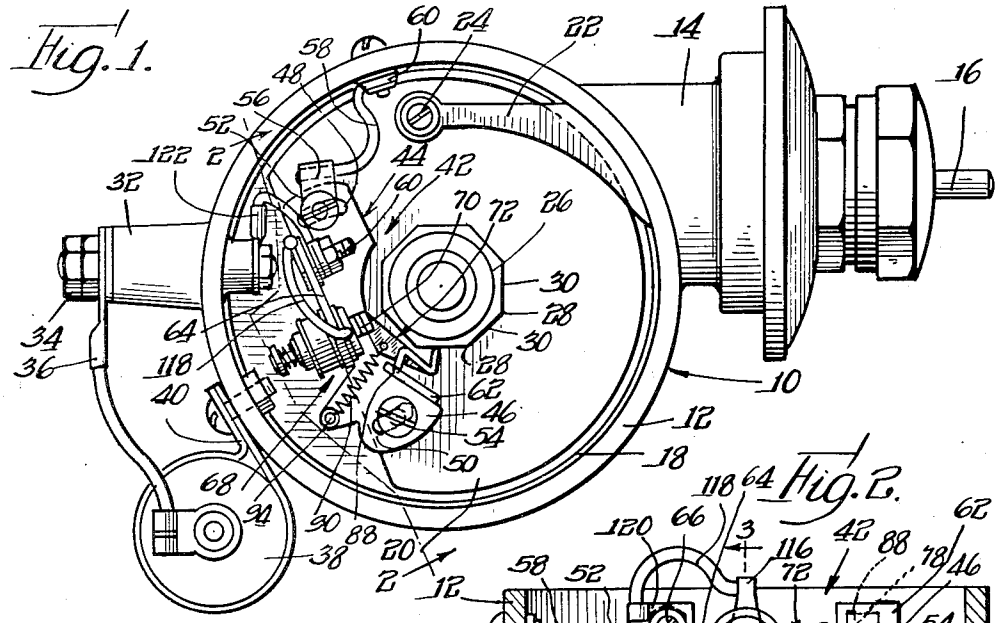


Fig. 2.

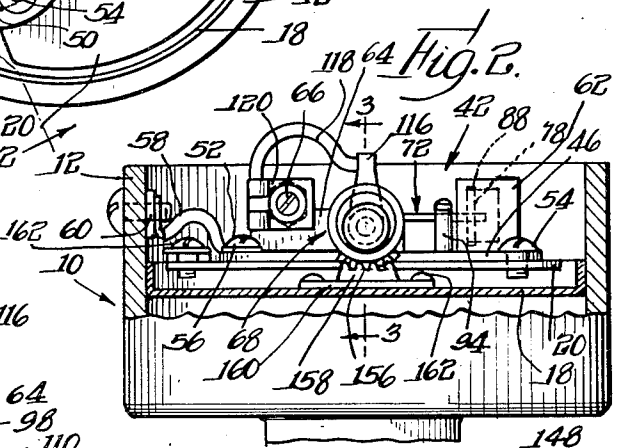


Fig. 3.

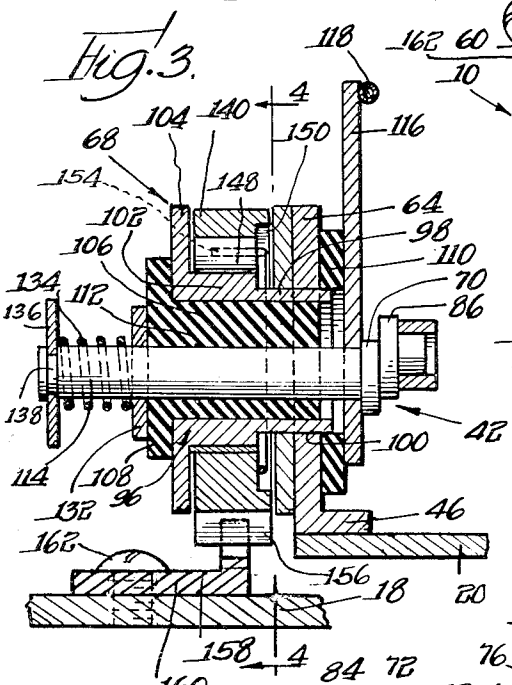


Fig. 4.

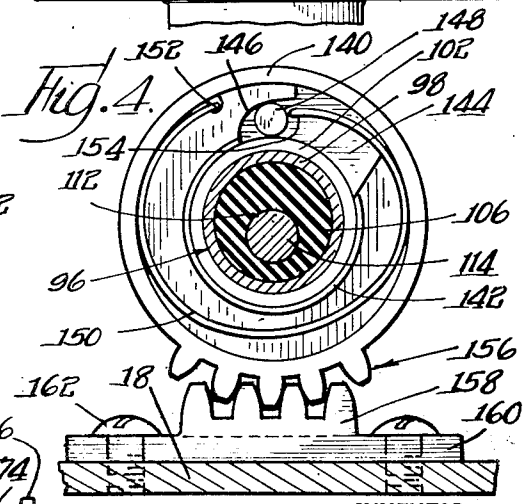
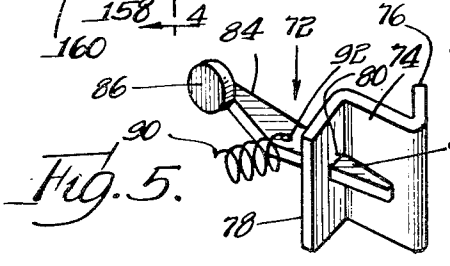


Fig. 5.



INVENTOR.

Stephen C. Baker

BY

Olson & Trexler

attys.

United States Patent Office 2,773,141 Patented Dec. 4, 1956

2,773,141

IGNITION ELEMENT

Stephen C. Baker, North Riverside, Ill.

Application December 24, 1953, Serial No. 400,175

10 Claims. (Cl. 200—31)

This invention is concerned with an ignition element, more specifically an improved breaker point mechanism for the distributor of a spark ignited, internal combustion engine.

Conventional breaker points for spark ignited, internal combustion engines provide a pair of similar, flat surfaced contacts, generally known as "points." The points are periodically opened and closed by a cam driven by the engine for providing sparking energy to the spark plugs.

The arc occurring between these contacts as the contacts are moved away from one another to cause collapse of the primary field in the ignition coil, and hence generation of a high voltage in the secondary coil, burns the contacts or points. More specifically, metal is carried by the arc from one of the contacts to the other, thus forming a pit or crater in the first contact and a corresponding built up pile or hill on the other contact. The metal is oxidized as it is carried over, and the pile or hill built up thus is a relatively poor conductor. This leads to a poor spark. In addition, the oxidation of the metal increases the volume and causes the hill to build up faster than the pit or crater is formed. This progressively decreases the gap between the contacts when they are open, promoting more severe arcing and burning, destroys the proper ratio of open to closed time of the contacts or points, and eventually causes shorting out of the contacts or points.

Another common defect of prior distributors and breaker points is that the inertia of the moving breaker point and the arm carrying it causes the follower to leave the cam at high speeds, thus increasing the open time of the contacts, and decreasing the closed time to a degree where the field in the ignition coil does not build up properly, thus resulting in a relatively weak spark. Previous arrangements have been designed to overcome this fault, and such arrangements generally include a double follower so that the moving parts are under positive control of the cam at all times. The structure of such double followers is relatively complicated, and generally occupies too much space.

It is an object of this invention to provide an improved breaker point construction having substantially reduced inertia of the moving parts, whereby to maintain the moving parts under control of the cam at all speeds of operation without the necessity of a double follower.

A further object of this invention is to provide a breaker point construction having a smaller gap permissible than heretofore thought possible, thereby reducing the necessary travel distance of the moving parts and facilitating proper following of the cam at all speeds.

Another object of this invention is to provide an improved pivot for ignition breaker points to avoid looseness of parts.

Yet another object of this invention is to provide an improved breaker point construction wherein one of the points or contacts from time to time is moved in an orbital path to provide fresh contacting surfaces.

A further object of this invention is to provide an improved breaker point construction wherein one of the breaker points moves about an orbital path and is restrained against rotation about its own axis.

Yet another object of this invention is to provide in a breaker point construction having a relatively fixed contact orbitally movable about the axis of a relatively movable contact, improved means for effecting such orbital movement.

A further object of this invention is to provide an improved breaker point construction wherein the cam follower and contact surfaces wear away at substantially the same rate, whereby to avoid the necessity of periodic adjustment of the breaker point gap.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying drawings wherein:

Fig. 1 is an end view of a distributor constructed in accordance with the principles of my invention;

Fig. 2 is a side view partially in section taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3 showing the internal construction of the clutch; and

Fig. 5 is a perspective view of the movable breaker arm and cam follower.

A distributor **10** of generally conventional construction is illustrated in Figs. 1 and 2 and includes a cylindrical casing **12** preferably of metal and having a fitting **14** on the side thereof adapted to be connected at **16** to a vacuum line leading to the carbureter. The distributor is provided with a fixed plate **18** normal to the axis of the distributor, and has a spark advance plate **20** pivotally mounted thereon in accordance with conventional practice. A link **22** is pivotally connected to the spark advance plate **20** at **24** and extends into the fitting where it is conventionally connected to a diaphragm (not shown) for vacuum advance of the spark advance plate **20** according to conventional practice. Centrifugal spark advance means also may be used, but are not shown. The distributor further includes a cam **26** of conventional construction rotatably driven by the engine on which the distributor is mounted. The cam is provided with high spots **28** and low spots or dwells **30** in accordance with the number of cylinders in the engine. The cam is illustrated as having eight high spots for an eight cylinder engine. The distributor further includes a substantially radially disposed insulating boss **32** through which a connector rod extends according to conventional practice. This rod is provided at its outer end wtih nuts **34** for securing an eyelet **36** on a flexible lead connected to a condenser **38**, the latter being mounted by means of a bracket **40** on the side of the distributor and grounded to the body of the distributor by this bracket.

The invention resides in the parts hereinafter to be described, said parts including a breaker point structure **42** comprising a bracket **44** having a flat plate portion **46**. The plate portion **46** is provided adjacent its opposite ends with arcuate slots **48** and **50**. Screws **52** and **54** are passed through these slots and are threaded into suitable tapped apertures in the spark advance plate **20** for adjustably mounting the bracket **42** on this plate. An eyelet **56** is clamped under the head of the screw **52** and is mounted on a wire **58**, the other end of which may be secured to an eyelet for connection by means of a nut and bolt **60** for grounding the bracket **42** to the cylindrical body **12** of the distributor.

The plate-like portion **44** is provided along one edge

with a right angularly disposed pivot flange 62, the purpose of which will be disclosed hereinafter more fully. The opposite end of the plate-like member 46 also is provided with a mounting flange 64 extending generally in the same direction as the flange 62. This pivot flange is provided with a screw binding post 66 which is insulated from the flange 64 by any known or convenient means. Structure 68 mounting the relatively fixed contact 70 for orbital movement also is mounted on the flange 64, and will be described later in greater detail.

The movable breaker arm, breaker point, and cam follower unit 72 may be seen best in Fig. 5 and comprises a substantially Z-shaped metallic sheet 74, one edge 76 of which forms a cam follower, and the opposite edge 78 of which forms a pivot. The pivot flange of the Z-shaped metallic sheet 74 is provided with a slot or aperture 80 through which one end 82 of an essentially triangular arm 84 is positioned and welded or otherwise suitably affixed in place. A breaker point or contact 86 is welded on the outer end of the arm 84, and both this contact and the contact 70 are made of or plated with tungsten or some other suitable refractory conductive material. The points are of substantially equal size, and the contact 70 hereinafter will be referred to as the "fixed" or "relatively fixed" contact or point, while the contact or point 86 will be referred to as the "movable" or "relatively movable" contact or point.

The pivot flange 62 is provided with a slot or groove 88 in which the bearing edge 88 of the Z-shaped member 74 is received for pivotally mounting the movable unit 72. A light coil spring 90 is stretched between a hole 92 near the center of the arm 84, and a pin 94 projecting perpendicularly from the plate-like member 46. It will be apparent to those skilled in the art from an inspection of the drawing that the moving parts identified by the numeral 72 are substantially smaller than those conventionally used, thus having lower inertia. In addition to this, the substantial centrally located pivot 78, 88 leads to shorter moment arms, and consequently lower inertia. The coil spring 98 likewise has lower inertia than the leaf springs commonly used. The integral construction of the pivot flange 62 and the plate-like member 46 insures against loosening of the pivot as sometimes happens to the pivot arms of conventional constructions, such arms commonly being peened over or otherwise mechanically held in place.

The mounting structure 68 comprises a driven clutch member 96 having an extending hub or sleeve 98 rotatably journaled in an opening 100 in the flange 64. The driven clutch member 96 includes a central cylindrical portion 102 and a radial end flange 104. A fiber or other suitable insulating bushing 106 is fixed in the driven clutch member 96 and has an end flange 108. The fiber bushing, it will be observed, extends through the flange 64, but terminates short of the end of the sleeve 98 of the driven clutch member. A fiber or other suitable insulating washer 110 encircles the end of the sleeve 98 where it projects through the flange 64, the sleeve being terminated within the washer 110.

The bushing 106 is provided with a longitudinally extending eccentric aperture 112 in which is journaled a mounting rod or shaft 114 having the fixed contact 70 welded or otherwise secured on the end thereof beyond the insulating washer 110. A radially projecting arm 116 is affixed to the rod or shaft 114 between the insulating washer 110 and the fixed contact 70. A wire 118 is soldered or otherwise suitably secured to the outer end of this arm and leads to an eyelet 120 secured beneath the head of the bolt 66, the bolt and eyelet being insulated from the flange 64. A wire 122 is secured on the upper end of the bolt by means of a nut and leads to a contact extending through the boss 32 to complete electrical contact to the fixed contact or point 70. The wire 118 restrains the arm 116 to preclude rotation of the fixed point or contact 70 about tis own axis.

A metallic washer 132 encircles the rod 114 adjacent the flange 108 of the bushing 106. A coil spring 134 is compressed between this washer and a C-shaped washer 136 snapped into a restricted neck 138 adjacent the outer end of the rod or shaft 114. The spring 134 maintains the fixed contact 70 firmly seated in its proper axial position while allowing relative rotation between the rod or shaft 114 and the insulating bushing 106.

A driving clutch member 140 encircles the central cylindrical portion 102 of the driven clutch member from which it is separated by a metallic bearing sleeve 142. The bearing sleeve is interrupted coterminously with an arcuate discontinuity 144 in the driving clutch member. One edge of this discontinuity is arcuately relieved as illustrated at 146 and a clutch pin or roller 148 is received between this arcuately relieved surface and the cylindrical section 102 of the driven clutch member 96. A curved wire spring 150 is received in an end recess in the driving clutch member 140 and has one end thereof anchored at 152. The other end 154 is turned inwardly and abuts the pin or roller to tend to hold it against the arcuate surface 146. It will be apparent that when the driving clutch member 140 is rotated in a clockwise direction, the pin or roller 148 will be wedged between the surface 146 and the driven clutch member to drive the driven clutch member. On the other hand, when the driving clutch member is rotated in a counterclockwise direction, the surface 146 will move slightly away from the ball or roller and the driven clutch member will not be driven.

The driving clutch member 140 is formed with a gear sector 156 thereon, and at this point it might be mentioned that the driving clutch member and gear segment preferably are sintered from powdered metal to facilitate relatively inexpensive production of the gear segment and to allow substantially permanent lubrication thereof. A rack 158 meshes with the gear sector 156 and is provided with a right angularly disposed flange 160 secured to the distributor plate 18 by means such as a pair of screws 162.

Thus, each time the spark is advanced or retarded by vacuum movement of the spark advance plate 20, there is a relative rotary movement of the plates 18 and 20 which causes the rack 158 to impart an arcuate movement to the gear sector 156. Alternate movements of this sector will be in opposite directions, and every other one of these movements will effect rotation of the driven clutch member, and hence of the insulating bushing 106. The eccentric mounting of the rod or shaft 114 in the bushing 106 causes an orbital movement of the rod or shaft, and hence of the fixed contact point 70. The radially extending arm 116 and the wire 118 prevent rotation of the rod or shaft 114 and the contact point 70 about their own axes so that a fresh portion of the contacting surface of the point or contact 70 is presented for engagement with the movable contact or point 86 each time the fixed contact is moved orbitally. It will be apparent that a different part of the movable contact or point 86 also is presented for engagement with the fixed contact each time the first contact is moved orbitally.

The more or less random sequence of the orbital movement of the fixed contact point prevents undue wear on the parts such as would be effected by constant movement of the point. Furthermore, constant movement would cause a wiping action between the breaker points that would tend to produce a somewhat erratic, long spark rather than the quick, sharp spark desired. It is well known that a close spark gap setting produces more efficient ignition than a wide gap, but the pitting of one contact and building up of the other previously has precluded very close gaps. In accordance with this invention wherein fresh contacting surfaces are constantly presented to one another, it is possible to set the gap much more closely than heretofore thought possible. This produces more severe arcing than previously has been ac-

ceptable, but this is desirable as the severe arcing tends to blow much of the metal away from the breaker points so that there is very little building up of material. Consequently, erosion of one of the points or contacts tends to increase the maximum gap with use and aging of the contacts. However, at the same time the cam follower surface **76** of the movable breaker point unit **72** wears away on the cam **26**. Although I have shown the metal of the surface **76** directly engaging the metal of the cam **26**, it is contemplated that a cap or follower of some other material, such as nylon, could be molded or otherwise secured over the follower surface. Wearing away of the follower surfaces tends to decrease the gap, and it is apparent that this tendency to decrease the gap and the tendency to increase the gap due to erosion of one of the breaker points tend to counteract one another. It is apparent that by proper selection of materials these tendencies may be made to counterbalance one another so that adjustment of the gap setting is unnecessary during the useful life of the breaker points.

Use of the relatively small gap results in longer life for the cam and follower since the dwell period is longer and the cam follower consequently is actively contacted for a shorter period of time by the cam. The longer dwell furthermore results in a more efficient spark due to the longer saturation period of the ignition coil. The longer dwell period also results in shorter make and break time eliminating long travel of the movable breaker point arm, leading to less inertia, and thereby tending to eliminate contact float when the follower leaves the cam due to the relatively high inertia of previous breaker point arms.

Use of the breaker arm pivot construction disclosed eliminates the use of insulation previously used and this leads to lower weight of the movable breaker point arm unit. The small size of the movable unit effected at least in part by the elimination of the insulation leads to a short arc of movement, thus further reducing inertia. The relatively short arc and the low inertia permit the use of the coil spring disclosed, and this coil spring has considerably less inertia than the leaf springs heretofore found necessary. The total inertia of the moving parts thus is further reduced.

The fulcrum is formed integral with the mounting plate of the breaker point structure, and this precludes the possibility of its becoming loose, whereas in conventional construction a post is used which is peened or otherwise mechanically held in place. Such posts are prone to loosen. Such looseness leads to improper mating of the breaker points or contacts, thus causing a poor spark, and it also leads to improper engagement of the follower and cam leading to excessive wear of both of these parts.

It has been noted that the gear sector **156** preferably is sintered of powdered metal, but it is contemplated that the gear sector and driving clutch member could be molded of plastic material such as nylon. However, there is a possibility that engine heat might cause softening of the material sufficiently to allow embedding of the roller or pin **148** in the material.

Other and further modifications of the specific structure shown and described for illustrative purposes may be made and form a part of the present invention insofar as they fall within the spirit and scope of the appended claims.

I claim:

1. A circuit maker and breaker for ignition systems comprising a relatively stationary contact point, a periodically movable breaker arm, a relatively movable contact point carried by said arm in substantially confronting relation to the first contact point and movable into and out of engagement therewith, spark advancing means on said distributor for advancing and retarding spark timing in accordance with engine requirements, means operatively connecting one of said contacts to said spark advancing means for moving said one of said contacts orbitally about the axis of the other upon advancing or retarding of said spark advancing means, and means for restraining the orbitally moving contact against rotation about its own axis.

2. The circuit maker and breaker as set forth in claim 1 wherein the means for restraining the orbitally movable point from rotation about its own axis comprises a radially extending arm rigid with the said point, and a connection from said arm to a fixed part of said circuit maker and breaker.

3. A circuit maker and breaker for ignition systems comprising a relatively stationary contact point, a periodically movable breaker arm, a contact point carried by said arm substantially in confronting relation to the first contact point and movable into and out of engagement therewith, means for moving said breaker arm periodically to effect such movement into and out of engagement, one of said contact points being orbitally movable substantially about the axis of the other contact point, spark advancing means on said distributor and operable from time to time to advance and retard spark timing in accordance with engine requirements, means forming a one-way operative interconnection between said spark advancing means and said orbitally movable point for moving said orbitally movable point from time to time with stationary periods between the movements, said movements being at random relative to the movement of the contact points into and out of engagement.

4. A circuit maker and breaker for ignition systems comprising a relatively stationary contact point, a periodically movable breaker arm, a contact point carried by said arm substantially in confronting relation to the first contact point and movable into and out of engagement therewith, means for moving said breaker arm periodically to effect such movement into and out of engagement, means for advancing and retarding the movements of the contact points into and out of engagement relative to the breaker arm moving means, one of said contact points being orbitally movable substantially about the axis of the other contact point, means for moving said orbitally movable point from time to time with stationary periods between the movements, said means for moving the orbitally moving point being operated by said advancing and retarding means, said movements being at random relative to the movement of the contact points into and out of engagement.

5. A distributor construction including a stationary part and spark advance plate and means for rotatably advancing and retarding said plate relative to said stationary part, a relatively stationary contact point carried from said plate, a breaker arm movably carried from said plate, a contact point carried by said arm in substantially confronting relation to the first contact point, means for periodically moving said arm to move the second contact point into and out of engagement with the relatively fixed contact point, and means for revolving one of said contacts orbitally about the axis of the other, said orbital moving means including a one way clutch and an operative connection between the spark advancing plate and the stationary part of said distributor for effecting orbital movement each time the spark advance plate is rotated in a given direction.

6. A distributor construction as set forth in claim 5 wherein the operative connection for effecting orbital movement comprises a rack mounted on one of said plates and said stationary part, said clutch being mounted on the other of said plates and stationary part and having a plurality of gear teeth meshing with said rack.

7. The distributor construction set forth in claim 6 wherein the clutch comprises two relatively rotatable parts, a roller and means for wedging said roller into driving engagement between said two parts when one of said two parts is driven in a predetermined direction.

8. A breaker arm construction for an ignition system

contact maker and breaker of the cam operated type comprising a substantially Z-shaped strip of sheet material forming a pair of flanges each connected to the other at relatively opposite edges by a web, the free edge of one of said flanges serving as a pivot and a free edge of the other of said flanges serving as a cam follower, an arm projecting from the pivot flange generally oppositely of said web, and a contact point carried by said projecting arm substantially at the end thereof.

9. A circuit maker and breaker as set forth in claim 4 wherein the means for orbitally moving one of the contact points includes a one-way drive connection whereby the orbitally movable contact point is moved upon movement of the advancing and retarding means in one direction, but not in the other.

10. A circuit maker and breaker as set forth in claim 9 wherein the one-way drive connection comprises a one-way clutch.

References Cited in the file of this patent

UNITED STATES PATENTS

1,064,176	Smith	June 10, 1913
1,899,965	Irgens	Mar. 7, 1933
1,952,321	Lange et al.	Mar. 27, 1934
2,127,957	Ives et al.	Aug. 23, 1938
2,129,953	Mack	Sept. 13, 1938
2,387,961	Wihanto	Oct. 30, 1945
2,569,991	Hoffmann	Oct. 2, 1951
2,572,105	Bronstein	Oct. 23, 1951
2,634,343	Rainey	Apr. 7, 1953

FOREIGN PATENTS

171,818	Germany	June 15, 1906